

Richard P. Garrison, Ph.D., CIH, CSP

CURRICULUM VITAE – October 2006

Title	Associate Professor Emeritus of Industrial Health School of Public Health, University of Michigan
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Education	Ph.D. Industrial Health (1977) M.S. Industrial Health and Aerospace Science (1972) B.S.E. Aerospace Engineering (1970) All from the University of Michigan, Ann Arbor
Certifications	Certified Industrial Hygienist – CIH (1980 to present) Comprehensive Practice, Certificate No. 1780 Certified Safety Professional – CSP (1981 to present) Comprehensive Practice, Certificate No. 6583
Honors	Magna Cum Laude graduate, Aerospace Engineering (1970) John F. Branstrom Freshman Prize, University of Michigan (1967) Author of "Best Paper for 1980" in the <i>AIHA Journal</i> (MIHS Award) AIHA John M. White Awards for "Excellence in Respiratory Protection," co-author of research papers with Howard J. Cohen (1990, 1992) Scholarships: UM Regents Alumni (1966) Aerospace Engineering Department (1970) NIOSH Industrial Hygiene Traineeship (1972 - 1977)

**Professional
Consultation**

**Expert Witness in Chemical Exposure Assessment and
Design of Industrial Ventilation Controls**

Late 1980s to 2006 – Self-employment concurrent with
professorship at the University of Michigan

Beginning April 2005, all consultation activities
conducted through GARRISON Industrial Health, LLC

Multiple Cases Involving Specific Chemicals

Alleged chemical exposures
From late 1980s to present

Chlorpyrifos – Organophosphate insecticide

Applications in workplaces and in private residences
Application re-enactment and monitoring in a fast-food restaurant

Beryllium – Metal, metal alloys, and ceramics

Aerosols generated during manufacturing and product applications
Activities performed by contract workers

Asbestos – Fibers from a wide range of applications

Dusts associated with automotive friction products
Assessments of activities associated with individual work histories

Industrial Accidents

From late 1980s to late 1990s

Severe burns from a molten iron spill in an automotive engine foundry
Permanent brain damage from carbon monoxide in a confined space
Permanent brain damage from carbon monoxide in basement construction
Serious personal injuries from an explosion at a natural gas well head
Fatality from solvent vapors during coating application inside a tank
Serious leg injury in fall from truck tailgate and
potential exposures to formaldehyde and heat stress

Ventilation for Contaminant Control

Consultation and conceptual design
From late 1980s to present

HV/LV exhaust ventilation for beryllium dusts from surface grinding
Dilution of hydrogen peroxide to prevent exposures and
hair bleaching during sterilization of beverage containers
General ventilation system for a large concrete irrigation dam
Evaluation of recirculating ventilation systems for dust control
during grinding operations on special metal alloys
Local exhaust booth for plasma torch-cutting at a metal recycling facility

Individual Cases Involving Various Chemicals

Alleged chemical exposures
From late 1980s to late 1990's

Perchloroethylene in dry cleaning operations
Chromic acid mist in a chrome plating process
Isocyanate vapors in the manufacture of polyurethane foam products
Allergic dermatitis from contact with multifunctional acrylates
during cleaning of storage containers
Talc dust in rubber tire manufacturing
Silica dust during preparation of materials for investment casting
Solvent vapors and lead fumes with multiple-color printing presses
Solvent vapors and pigment dusts during paint manufacturing
Methyl acrylate from a leaking drum
Solvent vapors during manufacturing of small electric motors
Trichloroethylene during manufacturing of
automotive engine cooling system components
Solvent liquids and vapors during manufacturing of coated plastic films
Plastic fumes associated with "meat wrappers asthma"
Chemicals associated with electronics assembly
Monochlorobenzene during hydroblasting of heat-exchanger tubes
Isocyanates during pump maintenance
1,1,1-trichloroethane during machinery cleaning
Methyl methacrylate during the preparation of orthopedic bone cement
Solvent vapors associated with operation of a finger-nail salon

**Employment
History**

Consultant in Industrial Health (2005 to present)
Associate Professor Emeritus of Industrial Health (2006 to present)
 GARRISON Industrial Health, LLC
 Ann Arbor, Michigan

Principal and sole member of the LLC. Primary practice areas are chemical exposure assessment and expert witness as an industrial hygienist in matters under litigation. Continuation of consultation practice that began in the late 1980s, concurrent with professorship at the University of Michigan.

Associate Professor Emeritus of Industrial Health (2006 to present)
Associate Professor of Industrial Health (1985 to 2006)
Director of Industrial Hygiene Program (1992 to 1999)
Co-Director of Industrial Hygiene Program (2002 to 2005)
 Department of Environmental Health Sciences
 University of Michigan, Ann Arbor
Safety Officer for the School of Public Health (1994 to 2004)
Laboratory Design Coordinator (20% appointment, 1999 to 2004)
 Occupational Safety and Environmental Health
 University of Michigan, Ann Arbor

Associate Professor responsible for industrial hygiene (IH) teaching and research. The IH program is integrated with programs in occupational medicine, environmental health sciences, toxicology, and human nutrition, and it is closely associated with programs in ergonomics, safety engineering, and occupational health nursing. Retired from the active faculty in June 2006.

Director of the IH Academic Program providing MS, MPH, PhD, and DrPH degrees. Activities included curriculum development, student recruitment and enrollment, student financial support from a NIOSH training grant and other sources, securing and maintaining ABET accreditation, development of the OnJob/OnCampus degree program, and coordination of annual events.

Safety Officer for the School of Public Health reporting to the Associate Dean for Research and Facilities. Activities involved coordination of health, safety, and environmental compliance for offices and laboratories in SPH Buildings I and II. A Chemical Hygiene Plan was developed for SPH that was later adopted and implemented throughout the university.

Laboratory Design Coordinator reporting to the Director of OSEH, serving the office of the Vice President for Facilities and Operations. Activities involved consultation with OSEH, UM facility design and operations engineers, and outside contractors and architects on matters dealing primarily with renovation and construction of research laboratory facilities.

Research activities and interests have focused in the area of industrial ventilation, emphasizing exhaust hood design, confined workplaces, computer modeling, and high velocity/low volume ventilation. Research interests encompassed a wide range of ventilation applications and other engineering controls. Experimental facilities were designed, constructed, and operated. Exposure assessments were made for projects involving solvent exposures in automobile manufacturing and for manufacturing of organophosphate insecticides. Findings have been published in peer-reviewed articles, non-peer-reviewed articles, book chapters, and technical reports.

Manager of Safety and Industrial Hygiene (1984 - 1985)

Hospital Products Division
Abbott Laboratories, Abbott Park, IL

Management position reporting to Vice President for Scientific Affairs and Quality Assurance. Responsibilities included guidance and coordination of safety and industrial hygiene programs at thirteen (13) manufacturing plants, plus research and development operations, field sales, and administrative offices, involving approximately 9,000 employees. Major functions included audit and evaluation of plant safety and industrial hygiene activities, direction and assistance in program development, advising plant and division management on safety/health concerns and regulatory affairs, review of engineering projects and plans for new products and facilities, accident investigations and evaluation of accident trends. The Hospital Products Division manufactured a wide range of intravenous solutions, equipment and devices to administer solutions, medical electronic instruments, and other medical products with annual sales over \$1.5 billion in 1985.

Senior Industrial Hygienist (1983 - 1984)

Corporate Industrial Hygiene Department
Abbott Laboratories, North Chicago, IL

Senior staff position reporting to Director of Corporate Industrial Hygiene. Primary responsibilities included auditing plant industrial hygiene programs for all divisions and domestic operations, and consultation on selected industrial hygiene projects emphasizing engineering controls including ventilation. Activities included development and implementation of corporate policies and procedures, e.g., major issues including ethylene oxide sterilization and chemical hazard communication. Activities also included development of training materials, development of an industrial hygiene computer database, and support for divisional industrial hygiene and safety programs. Abbott Laboratories is a major manufacturer of pharmaceutical, hospital and home-health care products, medical diagnostic instruments, and agricultural and industrial chemicals, with world-wide sales exceeding \$3 billion in 1984.

Senior Consultant (1977 - 1983)

Occusafe, Inc., Wheeling, IL

Senior staff member reporting to the Executive Vice President and Technical Director. Primary responsibilities included staff and project management, review and approval of reports and proposals, and client development and sales. Activities and client services included on-site surveys and audits, policy and procedure development, plant and product evaluation, engineering controls and ventilation design, cost estimates, accident investigations, expert witness support, training programs, and OSHA compliance and inspection response. Occusafe was then recognized as a leading consulting firm in occupational and environmental safety and health. Clients were located nationwide and included major corporations, small and medium-sized businesses, and government agencies. A wide range of industries was served: chemical, petroleum, pharmaceutical, foundry, manufacturing, electronics, construction, and others.

Doctoral Candidate (1974 -1977)

Dept. of Environmental and Industrial Health
University of Michigan

Dissertation entitled *Nozzle Performance and Design for High Velocity/Low Volume Exhaust Ventilation* involved experimental investigations of fundamental HV/LV nozzle configurations. Testing and measurements were made of centerline velocity gradients, static pressure losses, and noise characteristics. Empirical data were developed into a computer design model.

Lecturer and Laboratory Instructor (1975 - 1977, Part-time)

Dept. of Environmental and Industrial Health
University of Michigan

Lectures to students, business, and labor groups on "Industrial Ventilation." Laboratory demonstrations and training exercises were developed for a graduate course in industrial ventilation.

Research Assistant (1971 - 1972, Part-time)

Department of Aerospace Engineering
University of Michigan

Sampling and analysis of air pollutants from natural gas combustion in a simulated stack, and construction and performance testing of airfoil surfaces modified by vortex generators.

Primary Teaching

Ventilation for Contaminant Control (1985 - 2005)

EHS 654 Sole instructor, 100% responsibility
On campus - Winter terms, annually
On Job/On Campus - Biannually

Occupational Safety (2000 – 2005)

EHS 552 Sole instructor, 100% responsibility
On Job/On Campus - Biannually

Occupational Health Aspects of Industrial Processes (1991 - 2005)

EHS 757 Primary instructor, 100% responsibility
On campus - Fall terms, annually

Fundamentals of Industrial Hygiene (1987 - 1990)

EHS 550 Primary instructor, 50% responsibility
On campus - Fall terms, annually
On Job/On Campus - Biannually

Industrial Hygiene Laboratory (1987 - 1997)

EHS 652 Second instructor - 15% responsibility
On campus - Winter terms, annually

Student Seminar in Occupational Health (1987 - 2000)

EHS 667 Sole instructor, 100% responsibility
On campus - Fall terms, annually

Professional Seminar in Occupational Health (1990 – 2000)

EHS 668 Primary coordinator, 100% responsibility
On Campus and OJ/OC – Winter terms, annually

Continuing Education Lectures (1986 to present)

Principal Topic -- *Ventilation for Contaminant Control*,
Other topics included – *Industrial Hygiene, Air Pollution,*
Indoor Air Quality, Ventilation for Confined Spaces,
and Computer Applications in Industrial Ventilation

**Primary
Research
Projects**

Industrial Ventilation Design

Ventilation for Work in Confined Spaces

Principal Investigator (20%, 1987 - 91)
National Institute for Occupational Safety and Health

Improved Engineering Control Techniques for the UAW-Ford

Principal Investigator (20%, 1988 - 1992)
UAW - Ford National Joint Committee on Health and Safety

Computer Design for Work in Confined Workplaces

Principal Investigator (20%, proposal submitted 1999, not funded)
National Institute for Occupational Safety and Health

Workplace Chemical Exposures

*Health Effects of Mixed Solvent Exposure: Case-Control
Investigation and Evaluation of Air Monitoring Data*

Co-Investigator (15%, 1988 - 1990)
UAW - GM National Joint Committee on Health and Safety

Effects of Chlorpyrifos on Human Behavior and the Nervous System

Co-Investigator (10%, 1999 - 2002)
Dow Chemical Company and Dow AgroSciences, LLC

Graduated Doctoral Students	Howard J. Cohen (1991) <i>Development, Testing, and Validation of a Field Method for Evaluating the Service Lives of Respirator Cartridges</i>
	Chulhong Park (1991) <i>Approximation of Three-Dimensional Velocity Characteristics of Local Exhaust Inlets Using the Boundary Element Method</i>
	Peggy A. Brady (1991) <i>Unattached Fraction of Radon Decay Products -- Potential Effects of In-House Air Cleaners on Lung Cancer Risk</i>
	Ravi Nabar (1994) <i>Residence Time Distributions and Computational Fluid Dynamics to Characterize Dilution Ventilation in a Confined Space Model</i>
Professional Memberships	American Industrial Hygiene Association (AIHA, 1977 - present) American Conf. of Governmental Ind. Hygienists (ACGIH, 1985 - present) American Society of Safety Engineers (ASSE, 1980 - present) Michigan Industrial Hygiene Society (MIHS, 1985 – present)
Professional Service	Editorial Board Member - <i>AIHA Journal</i> (1991- 2004) <i>AIHA Journal</i> -- Peer review of manuscripts (1988 – 2004) <i>Applied Occup. and Environmental Hygiene</i> -- Peer Review (1988 – 2004) NIOSH Peer Review -- Protocols for research projects on industrial ventilation (1986 and 1988) and for manuscripts to be submitted for publication (1985 and 1986) Peer review of two book chapters, Lewis Publishers (1992) Subcommittee to revise ANSI Standard Z43.1 (1992) AIHA Confined Spaces Committee (1984-1988 and 1993-96) Session Arranger (1984) and Vice Chairman (1985) AIHA Engineering Committee, 1980-1983, Session Chairman (1983) Ventilation '91 -- International Conference, Session Chair (1991) Panel Member, Confined Spaces Roundtables, AIH Conf. (1988 and 1991) Health Industries Manufacturers Assoc. "Right to Know" Training Film (1984)
University Service	Director of Industrial Hygiene Academic Program (1992 – 1999) Co-Director of Industrial Hygiene Academic Program (2002 – 2005) Manager of On Job/On Campus program in Ind. Hygiene (1985 – 2005) Co-Director of Comprehensive Ind. Hygiene Review Course (1990 – 97) Sponsored by AIHA, MIHS, and Univ. of Michigan NIOSH ERC Coordination of Annual Warren Cook IH Discussional (1985 – present) Consultation on renovation projects SPH Buildings I and II (1988 – 2005) Planning Group, health/safety training College of Engineering (1988 – 1990)

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PUBLICATIONS – October 2006

Peer-Reviewed Articles

1. Garrison, R.P. & D.H. Byers: Noise Characteristics of Circular Nozzles for High Velocity/Low Volume Exhaust Ventilation. *Am. Ind. Hyg. Assoc. J.* 41:713-720 (1980).
2. Garrison, R.P. & D.H. Byers: Static Pressure and Velocity Characteristics of Circular Nozzles for High Velocity/Low Volume Exhaust Ventilation. *Am. Ind. Hyg. Assoc. J.* 41:803-811 (1980).
3. Garrison, R.P. & D.H. Byers: Static Pressure, Velocity, and Noise Characteristics of Rectangular Nozzles for High Velocity/Low Volume Exhaust Ventilation. *Am. Ind. Hyg. Assoc. J.* 41:855-863 (1980).
4. Carmel, M.M. & R.P. Garrison: An Approach to RCRA Hazardous Waste Management. *Am. Ind. Hyg. Assoc. J.* 42:515-520 (1981).
5. Garrison, R.P.: Centerline Velocity Gradients for Plain and Flanged Local Exhaust Inlets. *Am. Ind. Hyg. Assoc. J.* 42:739-746 (1981).
6. Garrison, R.P.: Velocity Calculation for Local Exhaust Inlets -- Empirical Design Equations. *Am. Ind. Hyg. Assoc. J.* 44:937-940 (1983).
7. Garrison, R.P.: Velocity Calculation for Local Exhaust Inlets -- Graphical Design Concepts. *Am. Ind. Hyg. Assoc. J.* 44:941-947 (1983).
8. Crawford, G.N., R.P. Garrison & D.R. McFee: Odor Threshold Determination for 2-Nitropropane. *Am. Ind. Hyg. Assoc. J.* 45: B-7-8 (1984).
9. Crawford, G.N., R.P. Garrison & D.R. McFee: Health Examination and Monitoring Evaluation for Workers Exposed to 2-Nitropropane. *Am. Ind. Hyg. Assoc. J.* 46:45-47 (1985).
10. Garrison, R.P. and D.R. McFee: Confined Spaces -- A Case for Ventilation. *Am. Ind. Hyg. Assoc. J.* 47:A-708-714 (1986).
11. Garrison, R.P. and Y. Wang: Finite Element Application for Velocity Characteristics of Local Exhaust Inlets. *Am. Ind. Hyg. Assoc. J.* 48:983-988 (1987).
12. Garrison, R.P. and Y. Dong: Pitot Traverse with a Personal Computer. *Applied Ind. Hyg.* 3:18-22 (1988).
13. Garrison, R.P. and C. Park: Graphical Approximation Model for Velocity Characteristics of Local Exhaust Inlets. *Am. Ind. Hyg. Assoc. J.* 49:49-57 (1988).

14. Garrison, R.P. and M. Erig: Velocity Characteristics of Local Exhaust Inlets Facing an External Boundary Surface. *Am. Ind. Hyg. Assoc. J.* 49:176-184 (1988).
15. Garrison, R.P. and M. Erig: Airflow Characteristics of Two Symmetric Exhaust Inlets and of a Single Inlet Near an External Boundary Surface. *Applied Ind. Hyg.* 3:182-188 (1988).
16. Garrison, R.P., R. Nabar and M. Erig: Ventilation to Eliminate Oxygen Deficiency in a Confined Space -- Part One: A Cubical Model. *Applied Ind. Hyg.* 4:1-11 (1989).
17. Garrison, R.P. and C. Park: Evaluation of Models for Local Exhaust Velocity Characteristics -- Part I: Velocity Contours for Freestanding and Bounded Inlets. *Am. Ind. Hyg. Assoc. J.* 50:196-203 (1989).
18. Garrison, R.P. and C. Park: Evaluation of Models for Local Exhaust Velocity Characteristics -- Part Two: Velocity Gradients for an Inlet Near a Boundary Surface. *Am. Ind. Hyg. Assoc. J.* 50:204-209 (1989).
19. Garrison, R.P., Y. Dong, S.K. Lengerich and T.M. Rabiah: Performance Characteristics of Control Devices to Maintain Constant Face Velocity for Laboratory Hoods. *Am. Ind. Hyg. Assoc. J.* 50:501-504 (1989).
20. Cohen, H.J. and R.P. Garrison: Development of a Field Method for Evaluating the Service Life of Organic Vapor Cartridges -- Part 1: Results of Laboratory Testing Using Carbon Tetrachloride. *Am. Ind. Hyg. Assoc. J.* 50:486-495 (1989).
21. Garrison, R.P. and M. Erig: Ventilation to Eliminate Oxygen Deficiency in a Confined Space -- Part II: Noncubical Models. *Applied Ind. Hyg.* 4:260-268 (1989).
22. Rabiah, T.M., R.P. Garrison and R.K. Sachdev: Comparisons of Variable Volume Fume Hood Controllers. *ASHRAE Transactions.* 95(2):837-844 (1989).
23. Park, C. and R.P. Garrison: Multicellular Model for Contaminant Dispersion and Ventilation Effectiveness with Application for Oxygen Deficiency in a Confined Space. *Am. Ind. Hyg. Assoc. J.* 51:70-78 (1990).
24. Burge, H. and R.P. Garrison: Bioaerosol Investigations of Columbia Plaza. National Institute for Occupational Safety and Health. *NIOSH Pub. No. PB91-108191.* Government Printing Office, Washington, D.C. (1991).
25. Cohen, H.J., Zellers, E.T. and R.P. Garrison: Laboratory Validation of a Field Method for Determining the Service Lives of Organic Vapor Respirator Cartridges -- Part II: Humidity Effects. *Am. Ind. Hyg. Assoc. J.* 51:575-580 (1990).
26. Garrison, R.P. and M. Erig: Ventilation to Eliminate Oxygen Deficiency on a Confined Space -- Part III: Heavier-than-Air Characteristics. *Appl. Occu. & Environ. Hygiene.* 6:131-140 (1991).

27. Cohen, H.J., D.E. Briggs and R.P. Garrison: Development of a Field Method for Evaluating the Service Lives of Organic Vapor Respirator Cartridges -- Part III: Results of Laboratory Testing Using Binary Organic Vapor Mixtures. *Am. Ind. Hyg. Assoc. J.*, 52:34-43 (1991).
28. Cohen, H.J., S.L. Levine and R.P. Garrison: Development of a Field Method for Evaluating the Service Lives of Organic Vapor Respirator Cartridges--Part IV: Results of Field Validation Trials. *Am. Ind. Hyg. Assoc. J.*, 52:263-270 (1991).
29. Garrison, R.P., K. Lee and C. Park: Contaminant Reduction by Ventilation in a Confined Space Model -- "Toxic" Concentrations vs. Oxygen Deficiency. *Am. Ind. Hyg. Assoc. J.*, 52:542-546 (1992).
30. Nelson, N. A., T.G. Robins, R.P. Garrison, M. Shuman and R.F. White: Historical Characterization of Exposure to Mixed Solvents for an Epidemiologic Study of Automotive Assembly Plant Workers. *Applied Occup. & Environ. Hygiene*, 8:693-702 (1993).
31. Albers, J.W.; Garabrant, D.H.; Schweitzer, S.J.; Garrison, R.P.; Richardson, R.J., Berent, S. The Effects of Occupational Exposure to Chlorpyrifos on the Peripheral Nervous System: A Prospective Cohort Study. *Occupational and Environmental Medicine*, 61:201-211 (2004).
32. Albers, J.W.; Garabrant, D.H.; Schweitzer, S.J.; Garrison, R.P.; Richardson, R.J., Berent, S. Absence of Sensory Neuropathy Among Workers with Occupational Chlorpyrifos Exposure. *Muscle & Nerve*. 29:677-686 (2004).
33. Burns, C.J.; Garabrant, D.; Albers, J.W.; Berent, S.; Giordani, B.; Hاديar, S.; Garrison, R.P. and R.J. Richardson: Chlorpyrifos Exposure and Biological Monitoring Among Manufacturing Workers. *Occupational and Environmental Medicine*. 63:218-220 (2006).

Symposium Proceedings

34. Garrison, R.P.: Velocity Calculation for Local Exhaust Inlets -- Present Situation and Future Direction. *Ventilation '85 -- Proceedings of the First International Symposium on Ventilation for Contaminant Control*. pp. 775-78. Elsevier Science Publishers. Amsterdam (1986).
35. Garrison, R.P., C. Park and Y. Wang: Finite Element Modeling for Velocity Characteristics of Local Exhaust Inlets. *Ventilation '88 -- Proceedings of the Second International Symposium on Ventilation for Contaminant Control*. pp. 15-24. Pergamon Press. Oxford (1989).
36. Garrison, R.P., M. Erig, and C. Park: Testing, Modeling, and Guidelines for Ventilation of Confined Workplaces. *Ventilation '91 -- Proceedings of the Third International Symposium on Ventilation for Contaminant Control*. pp 553-565. Am. Conf. of Governmental Industrial Hygienists. Cincinnati, OH (1993).

Book Chapters

37. McFee, D.R. and R.P. Garrison: Process Characteristics of Open Systems. Chapter Three of *Industrial Hygiene Aspects of Plant Operations, Volume III: Engineering Considerations in Equipment*

Selection, Layout, and Building Design. pp. 38-65. L.V. Cralley & L.J. Cralley, editors. Macmillan Publishing Co., New York (1985).

38. McFee, D.R. and R.P. Garrison: Control of Open Process Systems. Chapter Three of *In-Plant Practices for Health Hazard Control*. pp. 33-57. L.J. Cralley and L.V. Cralley ed., John Wiley & Sons, New York (1989).

39. Garrison, R.P. and P. Brady: Personal Exposure Risks from Home Improvement and Repair. Chapter 4 of *Health and Safety Beyond the Workplace*. pp. 51-68. L.V. Cralley, L.J. Cralley, and W.C. Cooper ed., John Wiley and Sons, New York (1990).

40. Hansen, D.J., R.C. Radwin, T.J. Armstrong and R.P. Garrison: Computer-Aided Design in Industrial Hygiene. *AIHA Monograph -- Computers in Health and Safety*. pp. 107-124. G. Rawls ed., Am. Ind. Hyg. Assoc., Akron, OH (1990).

41. Garrison, R.P.: Ventilation for Contaminant Control. Chapter Eight of *The Work Environment, Volume I: Occupational Health Fundamentals*. pp. 129-151. D.J. Hansen, ed., Lewis Publishers, Inc., Chelsea, MI (1992).

42. Garrison, R.P. and N. McManus: Ventilation for Work in Confined Spaces, Chapter 11 of *Safety and Health in Confined Spaces*, pp. 467-507, N. McManus ed., Lewis Publishers, New York (1999).

43. Garrison, R.P.: Low-Volume/High-Velocity Exhaust Ventilation, *Handbook of Industrial Ventilation Design Guidebook*, in Chapter 10, pp.852-865, edited by H. Goodfellow and E. Tahti, Academic Press, New York (2001).

Technical Reports and Other Publications

44. Nicholls, J.A., S. Sichel, & R.P. Garrison: *Combustion Dynamics as Related to Air Pollution*. Technical Report UM 320057-1-P. The University of Michigan, Ann Arbor (1971).

45. Nicholls, J.A., S. Sichel, R.P. Garrison, et al.: *Combustion Dynamics as Related to Air Pollution*. Technical Report UM 320057-2-P. University of Michigan, Ann Arbor (1972).

46. Garrison, R.P.: *Nozzle Performance and Design for High Velocity/Low Volume Exhaust Ventilation*. Doctoral Dissertation. University of Michigan, Ann Arbor, MI, (1977).

47. Garrison, R.P.: *Ventilation for Work in Confined Spaces*. Testimony on Federal OSHA Standard: Permit Entry Confined Spaces (54 FR24080), delivered in Chicago, IL, February 2, 1990.

48. Garrison, R.P.: *Comments and Guidelines on Ventilation for Work in Confined Spaces*. Follow-up comments and questions answered on previous testimony, submitted to Occupational Safety and Health Administration, Washington, D.C., April 27, 1990.

49. Garrison, R.P.: *Ventilation for Work in Confined Spaces*. Project Report, R01-OH02329. National Institute for Occupational Safety and Health, Washington D.C. (1991).
50. Garrison, R.P.: *Engineering Controls for Vehicle Emissions in Drive-Off Areas of Assembly Plants*, Final Report, April 18, 1990. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1990).
51. Garrison, R.P.: *Evaluation of High Velocity/Low Volume Exhaust Ventilation*, Final Report, April 18, 1990. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1990).
52. Garrison, R.P.: *Ventilation Studies of Utility Tunnels at the Ford Rouge Manufacturing Complex*, Final Report, December 4, 1991. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1991).
53. Garrison, R.P.: *Ventilation Study of Electrical Manholes at the Ford Rouge Manufacturing Complex*, Final Report, December 11, 1991. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1991).
54. Garrison, R.P.: *Ventilation Studies of TCE Degreasers at the Ford Sheldon Road Plant*, Final Report, December 18, 1991. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1991).
55. Garrison, R.P.: *Ventilation for Work in Confined Spaces at Three Ford Assembly Plants -- Dearborn, Michigan Truck, and Wayne*, Final Report, December 11, 1992. UAW/Ford National Joint Committee for Health and Safety. Project No. 389732, University of Michigan, Ann Arbor (1992).
56. Albers, J.W., Berent, S., Garabrant, D., Garrison, R.P., Giordani, B., Richardson, R. *The Effects of Chlorpyrifos on Human Behavior and the Nervous System*, Final Report October 20, 2003. Dow AgroSciences LLC, Indianapolis, IN; University of Michigan, Ann Arbor (2003).

Presentations on Industrial Health and Ventilation Control

1. Noise Characteristics of Circular Exhaust Nozzles for HV/LV Ventilation. Am. Ind. Hyg. Conf., Houston, TX, 1978.
2. Static Pressure and Velocity Characteristics of Circular Exhaust Nozzles for HV/LV Ventilation. Am. Ind. Hyg. Conf., Houston, TX, 1978.
3. Static Pressure, Velocity, and Noise Characteristics of Rectangular Nozzles for HV/LV Ventilation. Am. Ind. Hyg. Conf., Chicago, IL, 1979.
4. Centerline Velocity Characteristics of Plain and Flanged Exhaust Inlets. Am. Ind. Hyg. Conf., Portland, OR, 1981.

5. Empirical Design Equations for Velocity Calculation of Local Exhaust Inlets. Am. Ind. Hyg. Conf., Philadelphia, PA, 1983.
6. Graphical Design Concepts for Velocity Calculation of Local Exhaust Inlets. Am. Ind. Hyg. Conf., Philadelphia, PA, 1983.
7. Velocity Calculation for Local Exhaust Inlets -- Present Situation and Future Direction. Ventilation '85 -- First International Symposium on Ventilation for Contaminant Control, Toronto, 1985.
8. Computer Modeling of Velocity Characteristics for Local Exhaust Inlets. Am. Ind. Hyg. Conference, Montreal, 1987.
9. Ventilation Characteristics of a Confined Space Model. Am. Ind. Hyg. Conf., San Francisco, CA, 1988.
10. Ventilation for Work in Confined Spaces. Am. Ind. Hyg. Conf., San Francisco, CA, 1988.
11. Finite Element Modeling for Velocity Characteristics of Local Exhaust Inlets. Ventilation '88 -- Second International Symposium on Ventilation for Contaminant Control, London, 1988.
12. Ventilation to Eliminate Oxygen Deficiency in a Confined Space -- Model Shape and Size Characteristics. Am. Ind. Hyg. Conf., St. Louis, MO, May 1989.
13. Multi-Cell Model for Contaminant Dispersion and Ventilation Effectiveness with Application for Oxygen Deficiency in a Confined Space. Am. Ind. Hyg. Conf., St. Louis, MO, May 1989.
14. Field Method for Evaluating the Service Life of Organic Vapor Respirator Cartridges -- Part One: Carbon Tetrachloride Testing. Am. Ind. Hyg. Conf., St. Louis, MO, May 1989.
15. Comparisons of Variable Volume Fume Hood Controllers. ASHRAE Conf., Vancouver, B.C., Canada, June 1989.
16. Field Method for Evaluating the Service Lives of Organic Vapor Respirator Cartridges--Laboratory Validation for Humidity and Mixed Solvent Effects. Meeting of the International Society for Respiratory Protection, November 7, 1989.
17. Ventilation to Eliminate Oxygen Deficiency in Confined Space Models--Heavier-than-Air Characteristics. Am. Ind. Hyg. Conf., Orlando, FL, May, 1990.
18. Performance Characteristics of Control Devices to Maintain Constant Face Velocity for Laboratory Exhaust Hoods. Am. Ind. Hyg. Conf., Orlando, FL, May, 1990.
19. Field Method for Evaluating the Service Life of Organic Vapor Respirator Cartridges--Results of Field Validation Studies. Am. Ind. Hyg. Conf., Orlando, FL, May, 1990.
20. Ventilation for Work in Confined Spaces--Studies, Standards, and Guidelines. Am. Ind. Hyg. Conf., Salt Lake City, UT, May, 1991.

21. Testing, Modeling, and Guidelines for Ventilation of Confined Workplaces. Spaces. Ventilation '91--Third International Symposium on Ventilation for Contaminant Control, Cincinnati, OH, September, 1991.

22. Development of an Excel Workbook for Designing Local Exhaust Ventilation Systems. Am. Ind. Hyg. Conf., Anaheim, CA, May, 1994.

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